

# Genetic Resources of Omega-3 Fatty Acid Crops

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## Introduction

The recent commercial interest in food products and dietary supplements containing omega-3 fatty acids for health benefits is an opportunity for creative new crop development.

## Objective

To provide germplasm curators and those interested in new crops with information in support of omega-3 research and development.

## Methods

Crop information was compiled and contrasted with NPGS holdings. In early 2005 on-line sources were used to develop a list of commercialized omega-3 crops and recommended foods. The SOFA (2005) www site was used to survey seed-derived sources of omega-3. This SOFA site has compiled the findings of many research publications, and cites the publications. We used other sources for information for omega-3 in foliage and fruit.

## Limitations

Our query on the SOFA site was for 18:3-Delta-9c,12c,15c\* . The query is for the most common plant form of omega-3. We are not presenting information about the other forms of omega-3 which could have commercial application.

Our table of non-commercial sources may include inedible or toxic items. They are included on the basis of omega-3 content regardless of practical potential.

## Results

### Foliage and Forage

The omega-3 content of foliage deserves greater attention. The information presented here is derived from just two reports. *Portulaca* is the best foliage source that we found in the literature (Simopoulos et al. 1992). Information on crops used for forage might help farmers produce animals with improved omega-3 content.

### Drying Oils

Omega-3 also has industrial use as a "drying oil" in paints, inks, and other products since it and other unsaturated fatty acids form molecular bonds that can produce durable finishes. Linseed oil the industrial form of flax seed oil is a widely used drying oil. The other unsaturated fatty acids oils have similar theoretical potential as drying oils. This potential is estimated by iodine values which measure unsaturation. Pure linolenic acid has a calculated iodine value of 261 (O'Brien, 2004, p. 189) which is higher than any actual crop oil iodine values as reported by Dean (1999, p. 10.69-10.73) or SOFA (2005).

### Germplasm Acquisition

The genera *Calamintha*, *Micromeria*, and *Plukenetia* are reported to have high concentrations of omega-3 and therefore could be acquired by the National Plant Germplasm System to facilitate research. Many of the other genera listed in our tables have very limited germplasm collections which may be worthy of expansion.

### Compare Omega-3 Crops

We see a need for more comparative study of these crops from an economic botany perspective.

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The National Plant Germplasm System (NPGS) distributes germplasm world wide free of charge for research (GRIN, 2005).

## Crops Used for Commercial Omega-3 Supplements Sold on the WWW

Genus	Family	Citation	Part	Percent omega-3 in oil	Percent oil by weight	NPGS acc.
<i>Borago</i>	Boraginaceae	SOFA	seed	0.10 to 22.93	20.70 to 38.30	3
<i>Cannabis</i>	Cannabaceae	SOFA	seed	16.10 to 28.00	17.20 to 47.40	0
<i>Cucurbita</i>	Cucurbitaceae	SOFA	seed	0.10 to 46.30	10.90 to 52.90	3374
<i>Juglans</i>	Juglandaceae	SOFA	seed	2.20 to 14.44	55.18 to 67.44	502
<i>Linum</i>	Linaceae	SOFA	seed	2.40 to 68.90	4.00 to 41.20	2983
<i>Perilla</i>	Lamiaceae	SOFA	seed	56.90 to 63.30	25.40 to 51.00	22
<i>Portulaca</i>	Portulacaceae	Simopoulos et al.	dry foliage	59.87 to 63.78	5.07 to 5.43	6
<i>Ribes</i>	Grossulariaceae	SOFA	seed	16.00 to 23.40	6.80 to 31.60	1383
<i>Salvia</i>	Lamiaceae	SOFA	seed	1.00 to 66.00	6.90 to 40.50	85
<i>Triticum</i>	Poaceae	Barnes	wheat germ	<1.0 to 12.3	5.2 to 15.5	50000

## Some Sources of Dietary Omega-3 Recommended in the Popular Literature

Genus	Family	Citation	Part	Percent omega-3 in oil	Percent oil by weight	NPGS acc.
<i>Brassica</i>	Brassicaceae	SOFA	seed	1.30 to 59.50	0.11 to 51.40	4574
<i>Glycine</i>	Fabaceae	SOFA *Nelson	seed	2.00 to 14.20 Or to 22%*	4.00 to 25.00	21307
<i>Mentha</i>	Lamiaceae	Pereira et al.	foliage	57.9% of fatty acids	0.325% wet basis	535
<i>Nasturtium</i>	Brassicaceae	Pereira et al.	foliage	47.6% of fatty acids	0.374% wet basis	2
<i>Persea</i>	Lauraceae	NDSR	fruit pulp	0.957% (or 0.111% of pulp)	13.7% fatty acids wet basis	300
<i>Sexamum</i>	Pedaliaceae	SOFA	seed	0.20 to 1.48	7.00 to 61.00	1229

## Not Commercial But High Omega-3 Content

Genus	Family	Citation	Part	Percent omega-3 in oil	Percent oil by weight	NPGS acc.
<i>Agrimonia</i>	Rosaceae	SOFA	seed	4.0 to 41.10	5.80 to 41.10	2
<i>Aleurites</i>	Euphorbiaceae	SOFA	seed	0.03 to 30.7	25.10 to 62.4	2
<i>Arabis</i>	Brassicaceae	SOFA	seed	51.38	19.10 to 39.00	2
<i>Calamintha</i>	Lamiaceae	SOFA	seed	56.80 to 68.40	25.80 to 50.00	0
<i>Calocedrus</i>	Cupressaceae	SOFA	seed	33.13	50.90	0
<i>Cryptanthus</i>	Boraginaceae	SOFA	seed	33.80 to 36.00	27.00 to 33.00	10
<i>Descarainia</i>	Brassicaceae	SOFA	seed	35.96 to 40.90	8.90 to 44.70	1
<i>Euphorbia</i>	Euphorbiaceae	SOFA	seed	0.20 to 76.40	7.00 to 60.00	215
<i>Helleborus</i>	Ranunculaceae	SOFA	seed	37.90 to 49.10	16.50 to 45.00	1
<i>Lallemantia</i>	Lamiaceae	SOFA	seed	57.00 to 68.00	15.20 to 33.00	10
<i>Malcolmia</i>	Brassicaceae	SOFA	seed	57.37	15.00 to 31.60	1
<i>Micromeria</i>	Lamiaceae	SOFA	seed	59.20 to 71.70	17.10 to 37.40	0
<i>Nicotiana</i>	Solanaceae	SOFA	seed	0.40 to 63.40	2.10 to 40.50	2204
<i>Odonites</i>	Scrophulariaceae	SOFA	seed	40.49	37.65	0
<i>Phyllanthus</i>	Euphorbiaceae	SOFA	seed	40	15.70 to 40.00	0
<i>Plukenetia (Tetracarpidium)</i>	Euphorbiaceae	SOFA	seed	45.10 to 65.00	54.00 to 61.62	0
<i>Salao (Blumenbachia)</i>	Loasaceae	SOFA	seed	33.90	0.40 to 39.30	0
<i>Saxifraga</i>	Saxifragaceae	SOFA	seed	28.50 to 53.10	25.00 to 47.00	8
<i>Tetradium (Etowia)</i>	Rutaceae	SOFA	seed	30.70 to 31.00	23.00 to 38.50	3
<i>Thuja</i>	Cupressaceae	SOFA	seed	28.53 to 45.00	31.9	7